



RESEARCH ARTICLE.....

Relative efficiency of rice-fish-duck production under integrated and conventional farming systems

KALPANA MANDAVI, S.P. SINGH, ASHUTOSH DUBEY, MANISHA CHAUDHARY AND RAJIV DIXIT

ABSTRACT..... The mono-cropping system of farming is most prevalent in most parts of the Chhattisgarh. However, the mono-cropping system has certain disadvantages as compared to that of integrated farming systems. Thus, to evaluate the efficacy of this system a study was conducted to determine the relative efficiency of integrated rice-duck-fish farming as compared to conventional rice-rice, duck-duck and fish-fish farming system. For present investigation, a field experiment was conducted at Integrated farming system model developed on 1.0 hectare of irrigated land at the farmer's field of Raigarh district. The data was calculated for its economics based on the rates prevailing during the study period while, labour requirement for various activities in duckery and fish production were recorded and given in man days per hectare. The system productivity, B:C ratio, employment generation was higher for IFS. The labour use efficiency was higher for fish-fish, duck-duck farming systems as compared to Integrated farming system. Thus, we can conclude that Integrated farming system was much better, economical and profitable as compared to that of mono-cropping system of farming.

KEY WORDS..... Integrated farming system, System productivity, B:C ratio, Employment generation

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HOW TO CITE THIS ARTICLE - Mandavi, Kalpana, Singh, S.P., Dubey, Ashutosh, Chaudhary, Manisha and Dixit, Rajiv (2016). Relative efficiency of rice-fish-duck production under integrated and conventional farming systems. *Asian J. Animal Sci.*, **11**(1): 49-52 (DOI : 10.15740/HAS/TAJAS/11.1/49-52).

ARTICLE CHRONICLE - Received : 29.12.2015; Revised : 28.04.2016; Accepted : 22.05.2016

INTRODUCTION.....

Hunger and malnutrition remain amongst the most devastating problems facing the world poor and needy (FAO, 2002). Ayyappan *et al.* (2004) reported that good *in situ* synergism exist between the fish and rice crop, improving the productivity of each other. Moreover, rural poultry farming constitutes important component of agricultural economy in India as small poultry holder are practically capable of more significant contribution to

alleviate malnutrition, poverty and unemployment. Integrated system of farming is based on the concept that output produced from one enterprise can be used as input for other interrelated enterprise, leading to higher efficiencies in nutrient recycling. Besides facilitating cash income, integrated farming system generates additional employment for family labour and minimizes the risk associated with conventional farming system. Thus, it increases profits due to reduced costs of feeds and

chemical fertilizers (Patricia *et al.*, 2011).

Integrated fish farming defined as linkage between two or more agro- related farming activities with one farming as major component .When fish become the major commodity in the system it is termed as integrated fish farming (IFF).The integration of fish farming with agriculture and animal husbandry is considered as sustainable farming system, which offers greater efficiency in resource utilization, reduces risk by diversifying crop, provide additional income and food for small scale farming household.This system involves recycling of bio-resources (on-farm and off farm) or by product and interconnected nutrient flow of one system as input for other, by increasing the production from same unit area. Freshwater aquaculture is organic based and derives inputs from agriculture and animal husbandry. India being an agrarian economy produces large quantities of plant and animal residues to the tune of over 322 and 1000 million metric tons, respectively, on annual basis support largest bovine population over 220 million cattle heads, along with 181 million sheep and goats 16 million pigs and over 150 million poultry and other livestock. Other commodity like mushroom, rabbit, sericulture and apiculture provide huge quantities of organic matter for aquaculture.The agro based industries also produce biomaterial with nutrient which could be recycled for fish farming in addition to the huge quantities of domestic sewage generated from urban cities to the extent of 4000 million liters /day. Hence, a study was conducted to determine the relative efficiency of integrated rice-duck-fish farming as compared to conventional rice-rice, duck-duck and fish-fish farming system.

RESEARCH METHODS.....

A field experiment was conducted at Integrated farming system model developed on 1.0 hectare of irrigated land at the farmer's field of Raigarh district. For duck farming, 200 khaki campbell breed of duck was reared in shed constructed near the fish pit. The ducks were fed with starter feed up to 20 days and later azolla along with farm waste (broken grains, fish meal, soyabean cake and vegetables) were used as the source of feed. The droppings were allowed to drop directly into the fish pit. For fish rearing, spawns and fingerlings *viz.*, rohu (30%), catla (30%) and

mrigal (40%) were reared @ 50,00,000/ha and 5000/ha, respectively. Only duckery droppings and local farm produce was served as the source of food. The data was calculated for its economics based on the rates prevailing during the study period while, labour requirement for various activities in duckery and fish production were recorded and given in man days per hectare. Since, the study includes diversified enterprises like fish and duck farming, thus, the yield was converted into rice equivalent yield with the method as suggested by Singh *et al.* (2005). The labour use efficiency was calculated by taking the ratio of total production in rice equivalent yield to the total man days per hectare.

Rice equivalent yield (REY) was calculated by using following formula:

$$REY = Y_f / P_r * P_f + Y_r$$

where,

Y_f =Yield of fish,

Y_r =Yield of rice,

P_f =Price of fish (Rs. kg⁻¹),

P_r = Price of rice (Rs. kg⁻¹).

RESEARCH FINDINGS AND ANALYSIS.....

The results obtained from the present investigation as well as relevant discussion have been summarized under the following heads :

System productivity :

The productivity of the system varied between the integrated and conventional farming system model. The system productivity of IFS was 16,675 kg/ha/yr, while that of conventional rice-rice, fish-fish and duck-duck farming system was 5000, 5962.5 and 4953.33 kg/ha/yr, respectively (Table 1). Ravishankar *et al.*, 2007 had also reported the similar findings. This may be attributed to the better growth, development and survival rate of fish and duck in integration with each other, resulting higher productivity of system.

Table 1 : The productivity of the system varied between the integrated and conventional farming system model

Farming system	Productivity kg/ha/yr
The system productivity of IFS	16,675 kg/ha/yr,
Rice-rice	5000 kg/ha/yr
Fish-fish	5962.5 kg/ha/yr
Duck-duck farming system	4953.33 kg/ha/yr

System productivity/day :

The system productivity/day of IFS was 45.68 kg/ha/day, while that of conventional rice-rice, fish-fish and duck-duck farming system was 13.69, 16.34 and 13.57 kg/ha/day, respectively (Table 2). It was due to higher system productivity of the IFS as compared to other conventional system.

Table 2: The system productivity/day of the system varied between the integrated and conventional farming system model

Farming system	Productivity kg/ha/day
The system productivity/day of IFS	45.68 kg/ha/day,
Rice -rice	13.69 kg/ha/day
Fish -fish	16.34 kg/ha/day
Duck-duck farming system	13.57 kg/ha/day

Benefit-cost ratio:

The benefit-cost ratio was also higher in IFS (1.55) as compared to the conventional rice-rice system (1.47). Among the other conventional systems, the B:C ratio of duck-duck farming system was highest (1.54) followed by fish-fish farming system (1.68) (Table 3). This may be due to the higher demand and price value for meat as compared to that of rice. Moreover, the use of rice byproducts for duck feed and the duckery droppings that increased the biological productivity of the pond (plankton production) and consequently reduces the cost of production. The economic advantages of rice-fish-poultry were also reported by Govindan (1988).

Table 3: Comparison of benefit-cost ratio in IFS as compared to the conventional system

Farming system	Benefit-cost ratio
The benefit-cost ratio of IFS	1.55
Rice -rice	1.47
Fish -fish	1.68
Duck-duck farming system	1.54

Employment generation :

The scope of employment generation and distribution

round the year without much lean and peak demand for labour was found in IFS. The present investigation revealed that integration of rice with fish and poultry required higher man days (575) over conventional rice-rice (235), fish-fish (94.21) and duck-duck (56.61) farming system (Table 4). Similar findings were also reported by Rangasamy *et al.* (1988).

Table 4: Employment generation and distribution of man power round the year in IFS as compared to the conventional system

Farming system	Employment generation (man days)
Employment generation (man days)	575
Rice -rice	235
Fish -fish	94.21
Duck-duck farming system	56.61

Labour use efficiency :

The labour use efficiency was higher in case of integrated farming system (29 kg/ha/labour), while that of conventional rice-rice system was 21.28 kg/ha/labour (Table 5). The higher efficiency of labour may be due to the better utilization of man power and higher rice equivalent yield in case of IFS. However, the labour use efficiency in case of fish-fish and duck-duck farming system was higher than IFS.

Table 5: Comparison of labour use efficiency

Farming system	Labour use efficiency kg/ha/labour
The labour use efficiency of IFS	29 kg/ha/labour
Rice -rice	21.28 kg/ha/labour
***labour use efficiency in case of fish-fish and duck-duck farming system was higher than IFS	

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